#2

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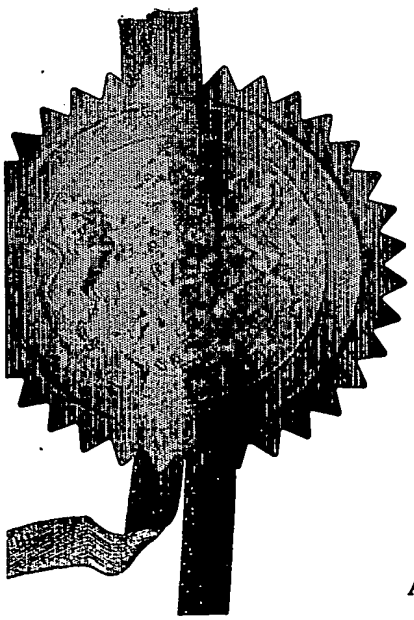

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P01/7700 0.00-0224999.3

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Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

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1. Your reference — D071735PGB

2. Patent application number *(The Patent Office will fill in this part)* — 0224999.3 — 26 OCT 2002

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Innoveytion Ltd, Henry Studdy House,
139 Bedeburn Road, Jarrow
Tyne & Wear, NE32 5AZ
United Kingdom

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation — United Kingdom — 8493371001

4. Title of the invention — CONVEYORS

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Marks & Clerk
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Suffolk Street Queensway
Birmingham B1 1TT
United Kingdom

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6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

Yes

Patents Form 1/77

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Continuation sheets of this form	
Description	15
Claim *(s)*	DMC
Abstract	
Drawing *(s)*	1L+11

10. If you are also filing any of the following, state how many against each item.

Priority documents	
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Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature [signature] Date 25 OCT 2002

12. Name and daytime telephone number of person to contact in the United Kingdom

David Carpenter 0121 643 5881

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CONVEYORS

This invention relates to belt conveyors primarily but not exclusively for use in the food industry.

Conventionally a belt conveyor comprises an elongate belt arranged as an endless loop supported at its ends by opposite roller assemblies, one of which may be driven. The belt defines upper and lower runs and is carried by a generally rigid supporting frame. The supporting frame consists generally of an elongate belt platform carrying the roller assemblies supporting the belt and a platform support structure usually in the form of a leg assembly supporting the belt platform in an elevated position relative to floor level.

In a conventional conveyor the frame of the conveyor is fabricated from a large plurality of separately formed components, by bolting or welding the components together. In many conveyor applications a fabricated frame is undesirable as the points of interconnection of components tend to become sites of corrosion in use. Moreover, in applications such as food processing, a conveyor frame fabricated from a plurality of individual components presents serious hygiene problems. The crevices defined where components are bolted together act as traps retaining food materials spilled from the conveyor (food spoil) and thus constitute sites for bacterial growth. By their nature such crevices are extremely difficult to clean and thus the cleanliness, and freedom from bacterial contamination, which is a prerequisite of the food industry, is difficult to maintain.

The use of welding, rather than bolted joints between components of the frame eliminates some of the crevices, but does not eliminate the hygiene problem. It is found that welding together of the components, particularly

where the components are formed from stainless steel, causes changes in the internal structure of the metal in the region of the weld which allows bacteria to penetrate the material at the grain boundaries of the material adjacent the weld resulting in bacterial colonisation of the material, leading to corrosion and the formation of crevices which can trap food spoil leading to further bacterial growth.

In consequence existing conveyors need to be cleaned frequently, using steam cleaning apparatus, caustic solvents, and significant amounts of manual labour, in order to preserve the hygiene standards necessary in the food industry.

It is an object of the present invention to provide a conveyor, suitable for use in the food industry, which facilitates the maintenance of the necessary hygiene standards with a lower frequency, or less intense, cleaning regime than is currently necessary.

In accordance with a first aspect of the present invention there is provided a conveyor in which substantially the whole of the belt platform of the conveyor is formed as a unitary component from a single sheet of metal.

In accordance with a second aspect of the present invention there is provided a conveyor in which substantially the whole of the frame of the conveyor, including the belt platform and the platform support structure is a unitary component formed from a single sheet of metal.

Preferably the design of the supporting frame of the conveyor is such that the frame is substantially free of surfaces which are horizontal in use.

It will be recognised that the avoidance of horizontal surfaces avoids the provision of ledges and the like upon which food spoil from the conveyor belt, and cleaning fluids, during cleaning, can collect. The surfaces of the conveyor frame will tend to shed, under gravity, food spoil and cleaning fluids to ground level.

One example of the invention is illustrated in the accompanying drawings wherein:

Figure 1 is a diagrammatic plan view of a metal blank, cut from a single sheet of metal, for bending to form the supporting frame of a belt conveyor;

Figure 2 is a view similar to Figure 1 showing, in broken lines, the principal bend lines along which the blank will be shaped to produce the frame;

Figure 3 is a diagrammatic perspective view of a unitary support frame of a belt conveyor, produced by bending and shaping the blank of Figures 1 and 2;

Figures 4, 5 and 6 are top, front, and end elevational views of the frame of Figure 3;

Figure 7 is an enlarged cross-sectional view of a side beam of the frame;

Figure 8 is a view similar to Figure 3 illustrating the attachment of adjustable feet to the frame of Figure 3;

Figures 9 and 10 are an end view and a cross-sectional view respectively of a first element of an adjustable foot, Figure 10 being a sectional view on the line A – A of Figure 9;

Figures 11 and 12 are end and side elevational views respectively of a second element of the adjustable foot;

Figure 13 is a perspective view of a roller assembly for éngagement with one end of the belt platform of the frame of Figure 3;

Figure 14 is a view similar to Figure 13, but showing the components of the roller assembly as an exploded view;

Figure 15 is a view of the roller cradle of Figures 13 and 14;

Figure 16 is a view similar to Figure 8 but illustrating the positioning of the roller assemblies at opposite ends of the belt platform;

Figure 17 is a view similar to Figure 16 but illustrating the engagement of the belt with the belt platform and roller assemblies;

Figures 18 and 19 are enlarged diagrammatic representations of part of the conveyor frame illustrating the assembly thereto of leg retaining members;

Figures 20 and 20a are perspective views of alternative leg retaining members;

Figure 21 is a diagrammatic perspective view illustrating the provision of roller assembly finishing caps;

Figure 22 is an exploded perspective view of the whole conveyor; and

Figure 23 is a diagrammatic perspective view of the assembled conveyor, with the belt thereof shown as a transparent or open weave belt so that underlying structure of the belt platform is apparent.

Referring to the drawings, the conveyor described herein with reference to the accompanying drawings is particularly, but not exclusively intended for use in the food industry. The conveyor may find use in conveying food industry raw materials, or partially or completely formed food products. However, it is to be understood that the conveyor may also find use in other environments not related to the food industry, particularly those environments where cleanliness and hygiene in relation to the conveyor is of importance.

It can be seen from Figure 22 that the conveyor comprises a metal support frame consisting of a belt platform 11 and a platform support structure including first and second leg assemblies 12, 13. The belt platform 11 includes first and second parallel side beams 14, 15 interconnected by a lattice structure 16. Roller assemblies 17, 18 are slidably received at opposite ends of the belt platform 11 respectively, and a conveyor belt 19 extends as a continuous loop around the roller assemblies 17, 18.

The conveyor frame is formed from "316 stainless steel" sheet, and in one particular embodiment the conveyor unit has a belt width of 280 mm, a conveyor length of 2,000 mm, and a frame height arranged so that the top

interstices which are of inverted U-shaped cross-section conferring significant rigidity to the lattice structure 16, and ensuring that the upper surfaces of the lattice are substantially free of horizontal ledges which could form a resting point for food spoil, or cleaning fluids.

Next the blank could be transferred to a brake-forming press to bend the beam regions 14a, 15a of the blank to the cross-section illustrated in Figure 7. As is apparent from Figure 7 the longitudinally extending, parallel, edge beams 14, 15 of the belt platform have a generally C-shaped cross-section, the upper edge of which is joined to the lattice 16 at a plurality of points along the edge of each beam by integral connecting strips 24. Each beam 14, 15 has a vertical wall 14b, 15b, inclined walls 14c, 14d and 15c, 15d on opposite sides of the wall 14b, 15b, a rounded top edge 14e, 15e and an inclined top edge region 14f, 15f terminating in the spaced connecting strips 24.

Integral with the lattice structure 16, and at opposite axial ends thereof, are first and second abutments 25 the purpose of which will be described in more detail hereinafter. It is to be recognised however that during the formation of the belt platform of the frame, the abutments 25 are bent downwardly so as to be parallel to the downwardly extending edge regions of the apertures of the lattice structure 16.

It will be recognised that the leg arrangements 12, 13 which constitute the support structure for the belt platform consist of three principal limbs indicated by the suffix a, b, c respectively, and which are integrally interconnected by integral joining elements indicated by the suffixes d and e respectively. The limbs 12a, 13a extend downwardly, co-planar with one another, from the lower edge of the wall 15d of the beam 15 of the belt

platform. The joining portions 12d, 13d are bent through an angle of approximately 80° so that the inclined limbs 12b, 13b extend both transverse to the width of the belt platform and longitudinally towards the mid-point of the length of the belt platform. The joining portions 12e, 13e are then bent through the same angle as the portions 12d, 13d but in the opposite direction so that the limbs 12c, 13c lie co-planar with one another and parallel to but spaced from the plane of the limbs 12a, 13a. The limbs 12c, 13c are positioned beneath the lower edge of the wall 14d of the beam 14 of the belt platform, and are aligned with downwardly extending tags 12f, 13f integral with the lower edge of the beam wall 14d. It will be recognised that this sequence of bending steps converts the planar unitary blank of Figures 1 and 2 into the three dimensional unitary conveyor support frame of Figure 3. The corners defined in the joining portions 12d, 13d and 12e, 13e can, as shown in Figure 3, be indented to strengthen the corners.

It will be recognised that the lower free edges of the limbs 12a, 12b, 13a, 13b lie in a common plane parallel to the plane of the belt platform 11 of the conveyor frame. The lower free edges of the limbs could be the floor engaging parts of the frame, but in order to accommodate the positioning of the conveyor on a non-planar floor the slots 23 at the free ends of the limbs 12a 12b, 13a, 13b are fitted with adjustable foot units 26. Each adjustable foot unit 26 comprises a first moulded synthetic resin body component 27 (Figures 9 and 10) having a central, screw threaded bore 28 and a pair of diametrically opposed longitudinally extending grooves 29 for receiving the edges of the slots 23 in the limbs 12a, 12b, 13a, 13b when the bodies 27 are introduced into the slots 23. The ends of the bodies 27 which are uppermost in use are closed, and are of externally domed configuration so as to avoid providing ledges upon which food spoil and cleaning fluids can collect. The screw threaded bore 28 of each body 27 is presented downwardly, and

longitudinally extending flanges 43 which enhance the rigidity of the base wall 39. The corners defined between the base wall 39 and the side walls 41 can be strengthened with indents 44 as shown in Figures 14 and 15. The length of the base wall 39 is such that the spacing between the outer faces of the side walls 41 is slightly less than the spacing between the inner faces of the vertical walls 14b, 15b of the edge beams 14, 15 of the belt platform. Furthermore, each side wall 41 is formed with integral upper and lower inclined flanges 45 the angle of inclination of which are substantially equal to the angle of inclination of the inclined upper and lower walls 14c, 14d, 15c, 15d of the beams 14, 15. Each carrier 38 can thus be slidably received in a respective end of the belt platform with the side walls 41 thereof co-operating with the interior faces of the edge beams 14, 15. Bearing strips 46 moulded from a low-friction bactericidal plastic material are bonded to the outer faces of the flanges 45 of the walls 41 to facilitate sliding movement of each roller assembly within the respective end of the belt platform.

At their ends remote from the base wall 39, each of the side walls 41 is bent inwardly to define a flange parallel to the base wall 39, and the flanges so formed are then bent again at right angles to define flanges 47 extending parallel to the respective side walls 41, but spaced inwardly from the side walls 41 and extending rearwardly towards the base wall 39. Each of the flanges 47 is formed with a U-shaped slot 48 extending downwardly from the upper free edge of the flange 47, the width of each slot 48 being equal to the width of the non-circular region of the shaft 37 of the roller unit 35. The ends of the shaft 37 are non-rotatably received in the slots 48 so that the carrier 38 supports a respective roller unit 35. The roller 36 of each roller unit 35 can rotate about the shaft 37 relative to the carrier 38.

One or both of the roller units 35 can, if desired, incorporate known electric drive means, and/or electric brake means whereby the roller 36 of the unit can be driven and braked to drive or brake the belt 19 in use.

Each roller assembly 17, 18 is introduced as a sliding fit in the respective end region of the belt platform and a resilient bellows arrangement 49 is interposed between the rear face of the respective base wall 39 and the abutment 25 which depends from the lattice structure 16 of the belt platform.

The belt 19 of the conveyor unit is an endless strip of flexible material, conveniently a nylon or polypropylene moulding. In the assembled conveyor unit the belt 19 extends around the roller units 35 of the roller assemblies 17, 18, and a top run of the belt 19 extends between the roller assemblies overlying the lattice structure 16 and having at its marginal edges downwardly (so far as the top run is concerned) extending continuous beads co-operating with the inwardly and downwardly turned edge region 14f, 15f of the edge beams 14, 15 so as to minimise the risk of food spoil falling between the edge of the belt and the respective beam. The imperforate nature of the belt 19 and its edge co-operation with the beams 14, 15 minimises the risk of food spoil reaching the lattice structure 16 of the frame. The lower run of the belt extends between the roller units 35 beneath the lattice structure 16 and the abutments 25, but passing above the limbs 12b, 13b of the leg arrangements.

The assembly of the belt 19 to the frame is as follows. After introduction of the roller assemblies 17, 18 into opposite ends of the belt platform, the resilient bellows units 49 are collapsed or compressed in any convenient manner to allow the assemblies 17, 18 to be moved as close as possible to one another, thus minimising the spacing between the roller units 35. The

section and has first and second aligned slots 52, 53 extending towards the mid-line of the moulding from opposite apical edges thereof. Although the slots 52, 53 extend towards one another, they terminate short of the mid-line of the retainer 51 so that the retainer 51 has a core equal in thickness to the width of the slot between the free end of a limb 12c, 13c and the free edge of the corresponding tag 12f, 13f. Furthermore, if desired in order to save material each retainer 51 could be moulded "cut away" at a number of points along its length so as to define a plurality of pairs of fingers 54, 55 spaced apart by the slots 52, 53 and equidistantly spaced along the length of the retainer. The slots 52, 53 would not extend through the full length of the retainer 51, so that there would be an unslotted region 56 at one axial end of the retainer to act as an abutment defining the fully inserted position of the retainer when the retainer is slid into place in the gap between the respective limb 12c, 13c and its associated tag 12f, 13f. However in most applications the "cut away" of the retainer 51 will be avoided so that the retainer is of diamond-shaped cross-section throughout its length presenting planar, unbroken, inclined surfaces upwardly in use as shown in Figure 20a.

As is apparent from Figures 18 and 19 each retainer 51 is slid laterally into the gap so that the tag 12f, 13f seats in the slot 52 while the upper free edge of the limb 12c, 13c seats in the slot 53. The portions of the retainer 51 which make facial engagement with the opposite faces respectively of the limbs 12c, 13c and tags 12f, 13f resist lateral displacement of the limbs 12c, 13c relative to the tags 12f, 13f, and the central core of each retainer 51 transmits vertical load from the beam 14 of the belt platform into the leg arrangements 12, 13.

Appropriate shaped, moulded, snap-on covers 57 are provided at the ends of the beams 14, 15 of the belt platform to cover the protruding parts of the

carriers 38 of the roller assemblies 17, 18. The covers are provided for aesthetic, safety, and hygiene reasons. The covers are moulded in a bactericidal plastic material, and snap engage with the flanges at the ends of the side walls 41 of the carriers 39. The covers 57 abut the end faces of the beams 14, 15 and overlie the protruding parts of the carriers 39 thereby minimising the risk of operatives trapping clothing or body parts in the roller assemblies. Moreover, the shaping of the covers avoids the presence of horizontal surfaces so minimising the risk of food spoil and/or washing fluids adhering thereto.

It will be recognised that the conveyor unit constructed as described above has its supporting frame formed from a single sheet of stainless steel, the only exception to this being the provision of the retainers 51 which are necessary to the structural integrity of the frame, and, in the example described, the adjustable feet 26 which are desirable in a practical embodiment. The use of a fabricated frame with the attendant problems of bolted or welded connections is thus avoided. Moreover, the shaping of the frame, and ancillary components thereto, is such as to minimise, and in this particular embodiment avoid completely, the presence of horizontal surfaces upon which food spoil and washing fluids can collect. The shaping of the frame promotes self cleaning and draining under gravity.

It will further be recognised that the assembly of the conveyor unit utilising the unitary frame is extremely simple, and can therefore be performed rapidly with a minimum of manual effort. In order to "strip-down" the conveyor for cleaning or maintenance the or each bellows unit 49 is collapsed to remove tension in the belt 19, the retainers 51 are withdrawn, and the belt 19 can then be withdrawn forwardly over the beam 14, the lower run of the belt passing between the upper edges of the limbs 12c, 13c and the tags 12f,

13f. Thereafter the roller assemblies 17, 18 can simply be withdrawn, and if necessary upon removal of the covers 57 the roller units 35 can be lifted out of their carriers 38. The frame and the other components can then be steam or spray cleaned, and again by virtue of the shaping of the frame it will be virtually self draining. Reassembly of the conveyor is equally simple.

It will be recognised that it is extremely desirable for the belt platform and the platform support arrangement to be integral with one another. However, complications in the formation of the three dimensional frame from the two dimensional blank may, in some applications, dictate that the belt platform should be formed from a separate blank to that from which the platform support arrangement is formed. It will be noted therefore that it is within the scope of this invention to provide means for attaching the whole of the platform support arrangement to the belt platform, the undesirable nature of a connection between parts of the frame being outweighed by the advantage to be gained in manufacturing technique. It will be accepted however that where practical it is desirable for the belt platform and the platform support arrangement to be integral parts of a unitary construction.

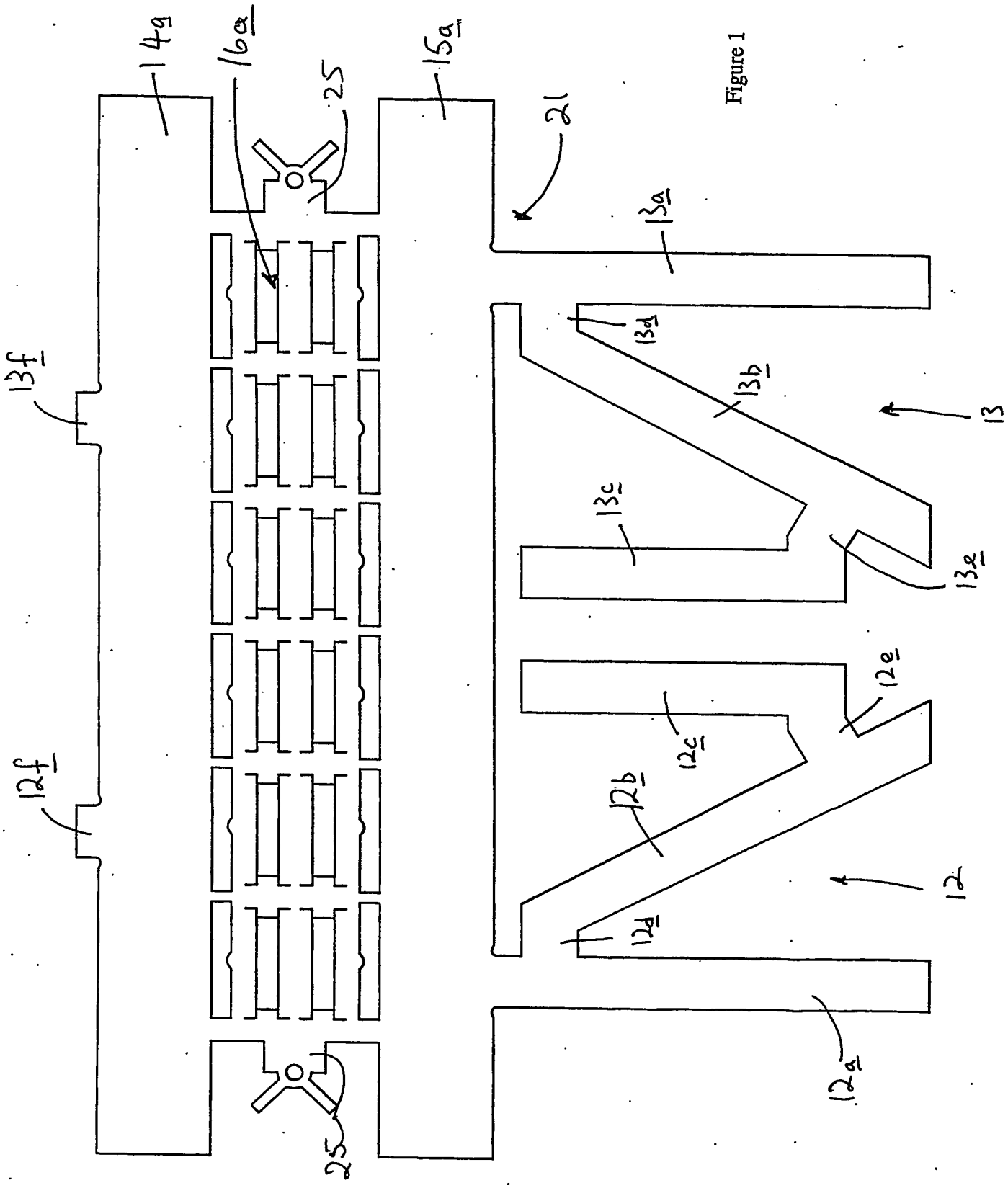
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Figure 1

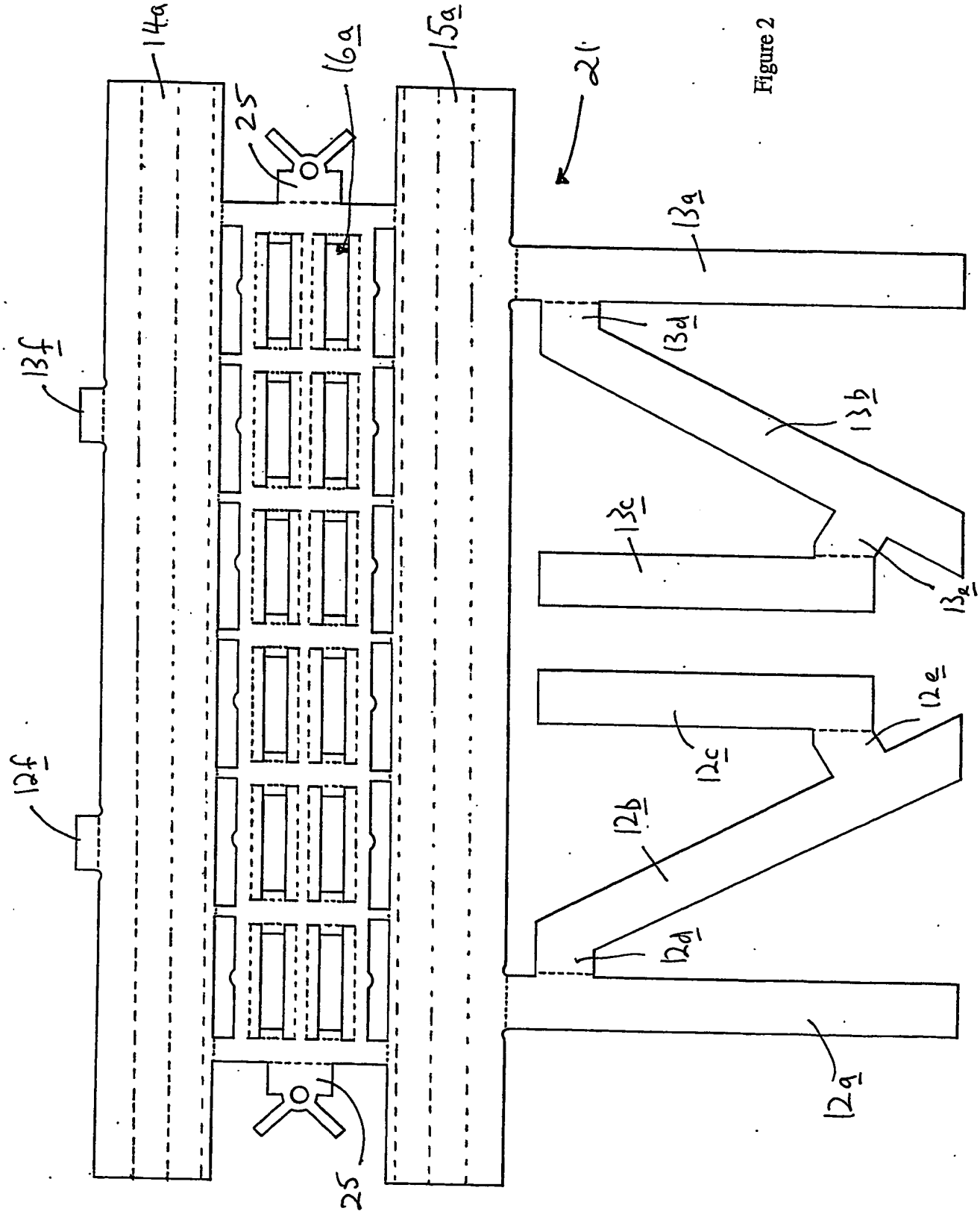
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Figure 2

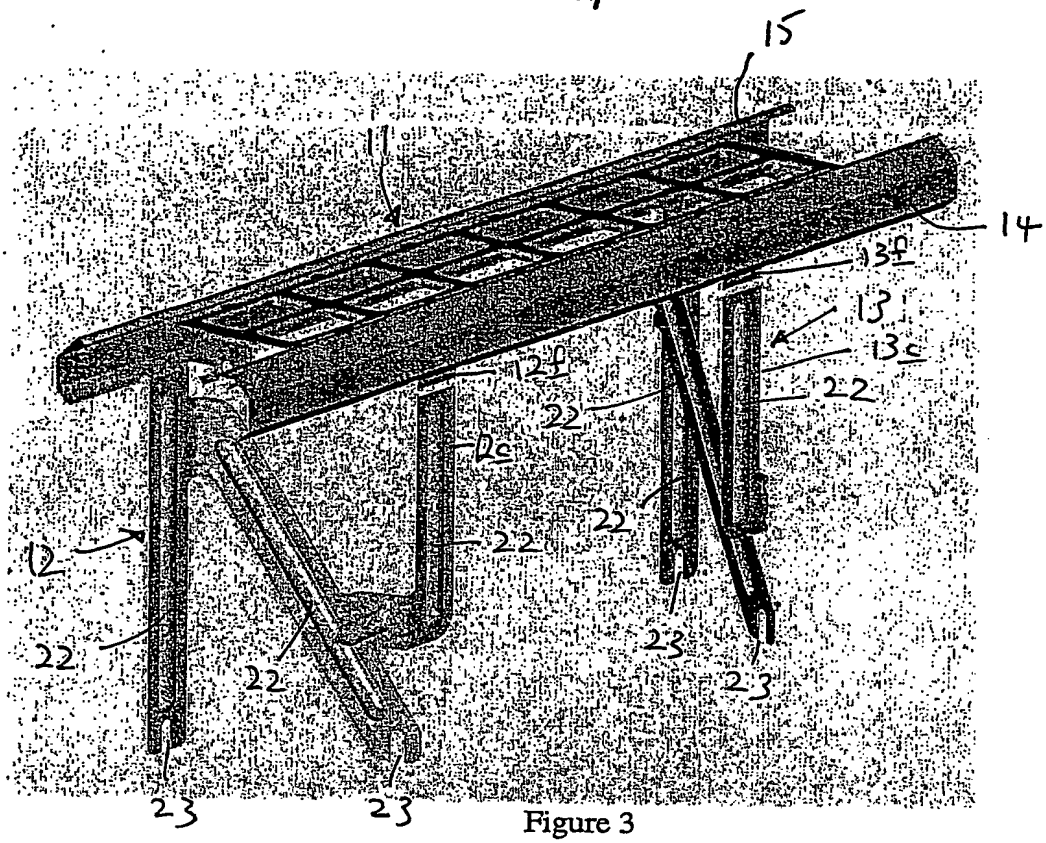

Figure 3

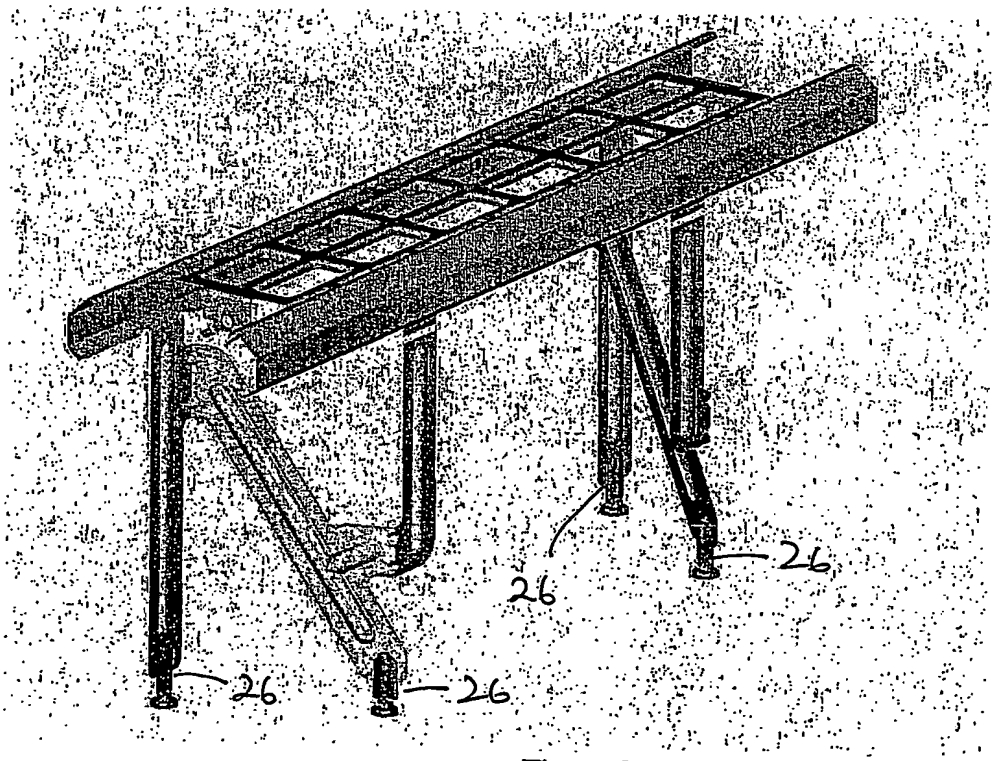

Figure 8

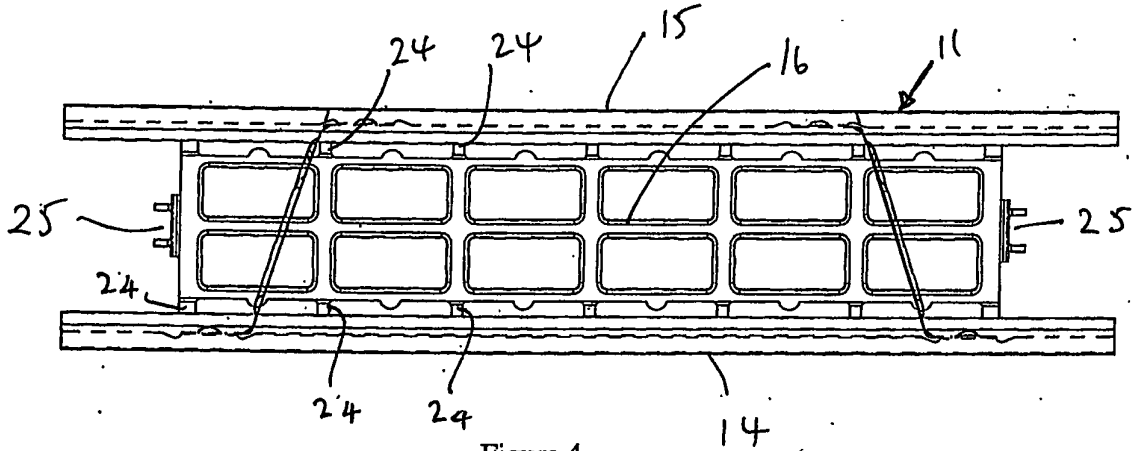

Figure 4

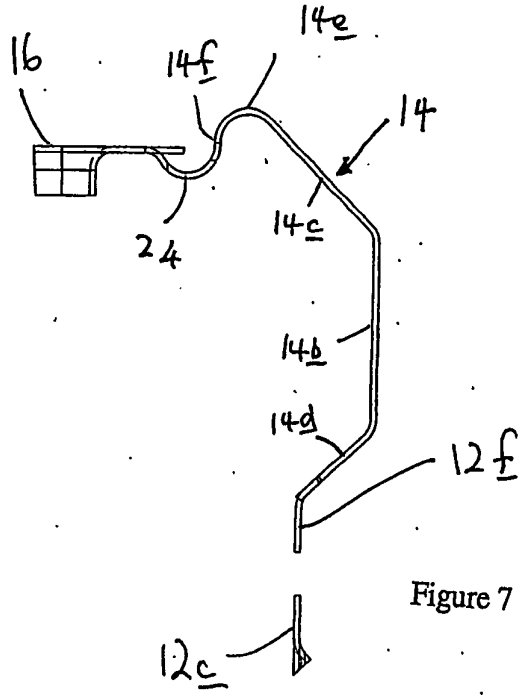

Figure 7

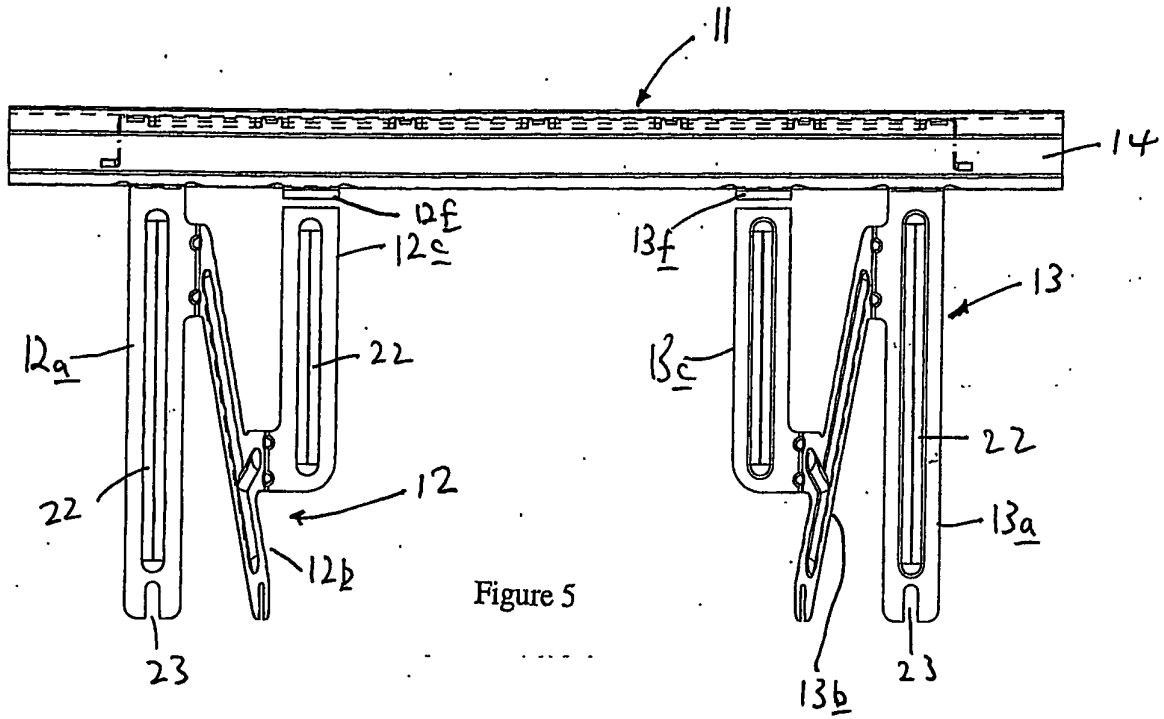

Figure 5

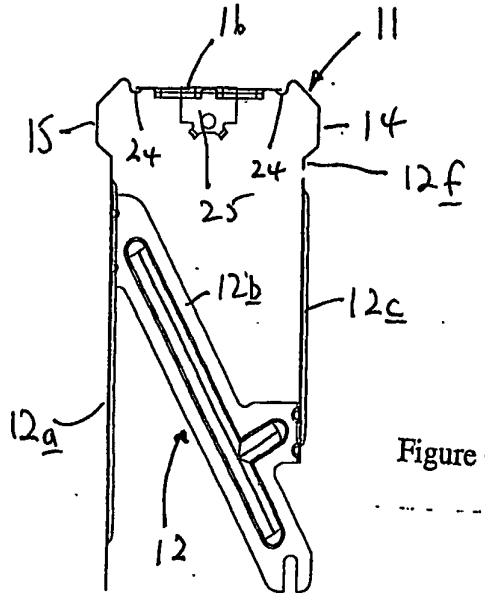

Figure 6

4/11

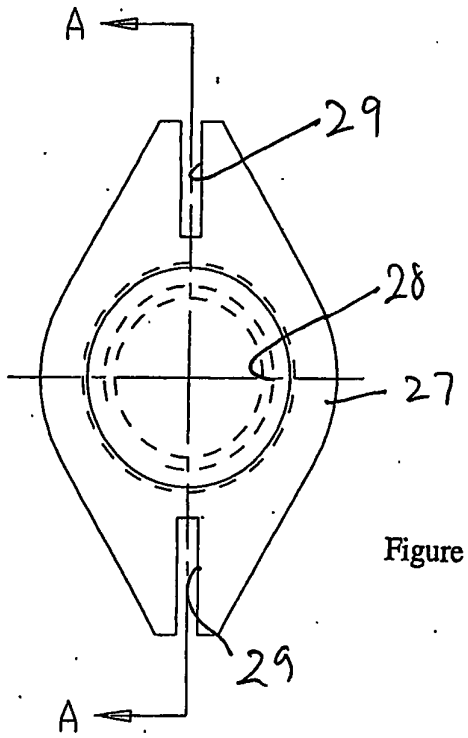

Figure 9

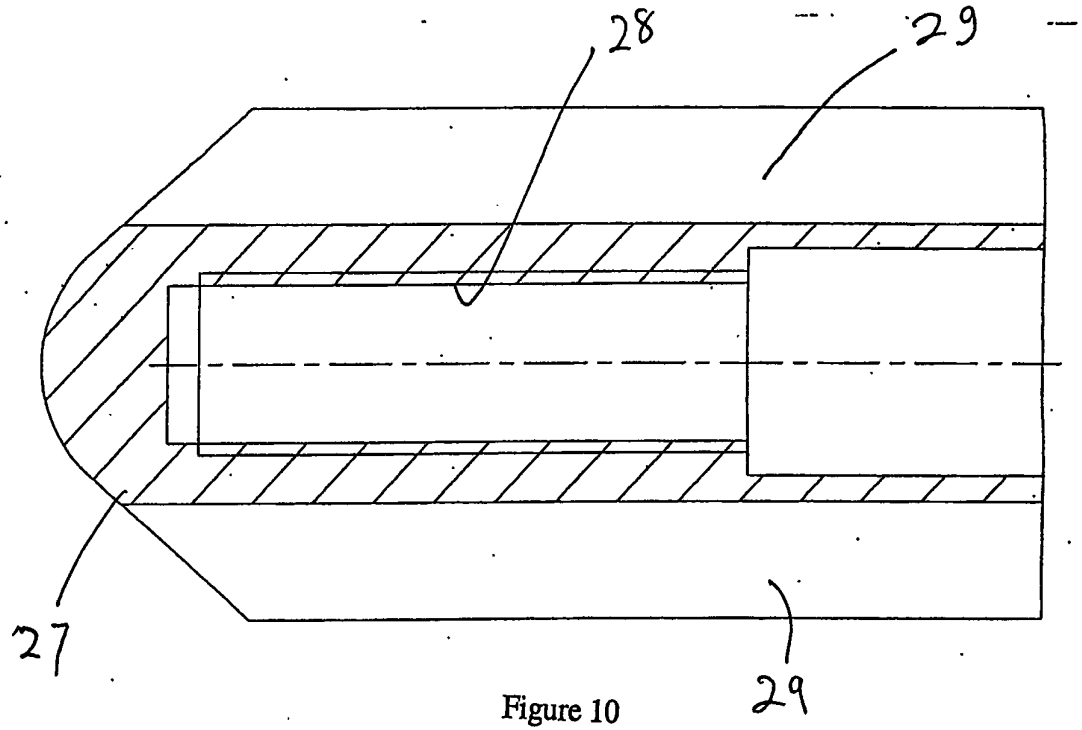

Figure 10

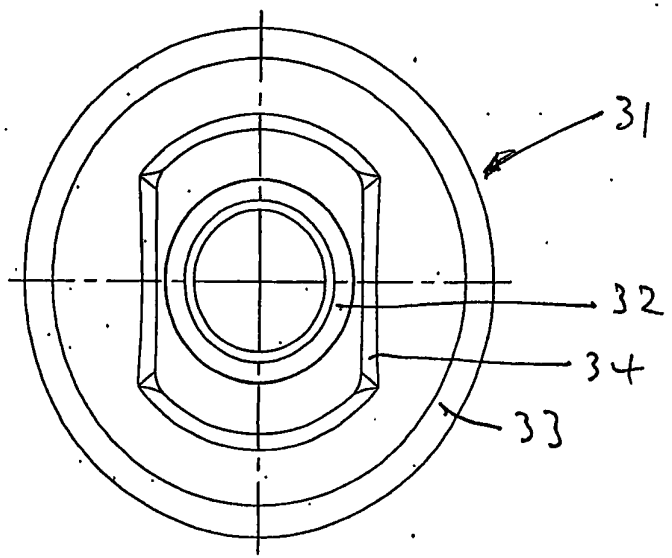

Figure 11

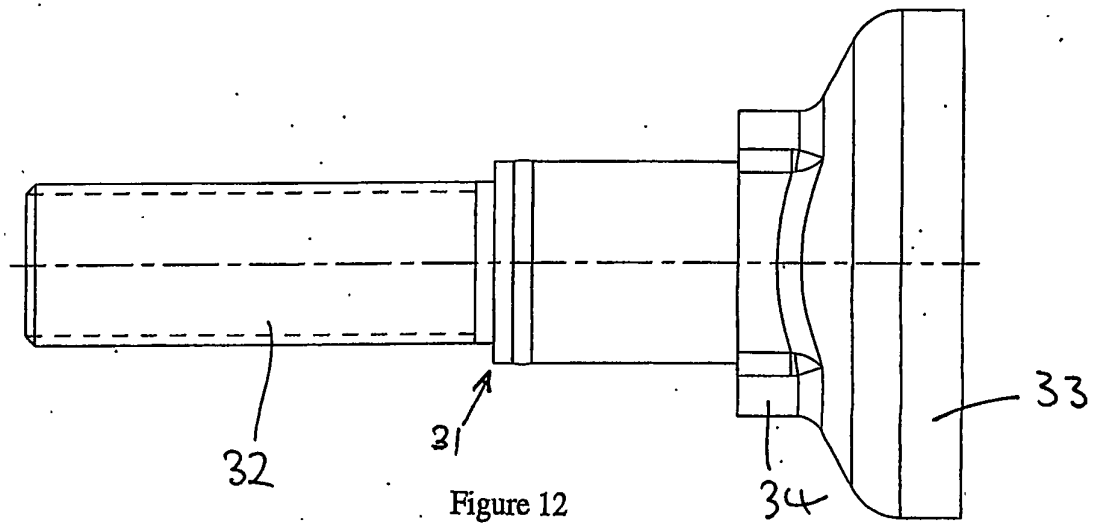

Figure 12

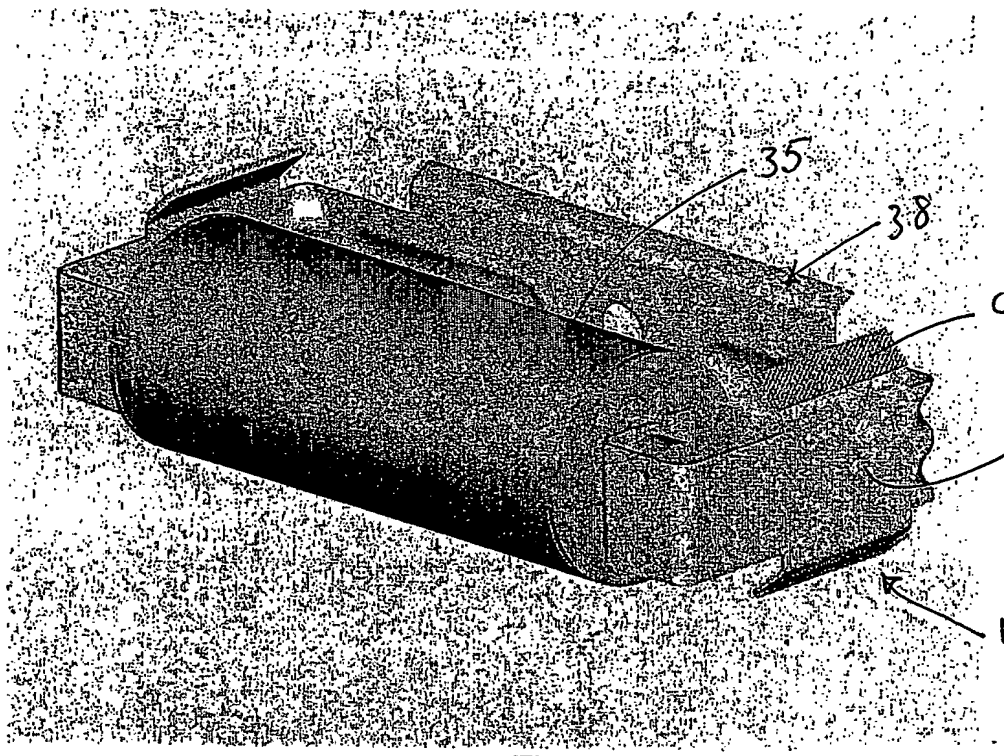

Figure 13

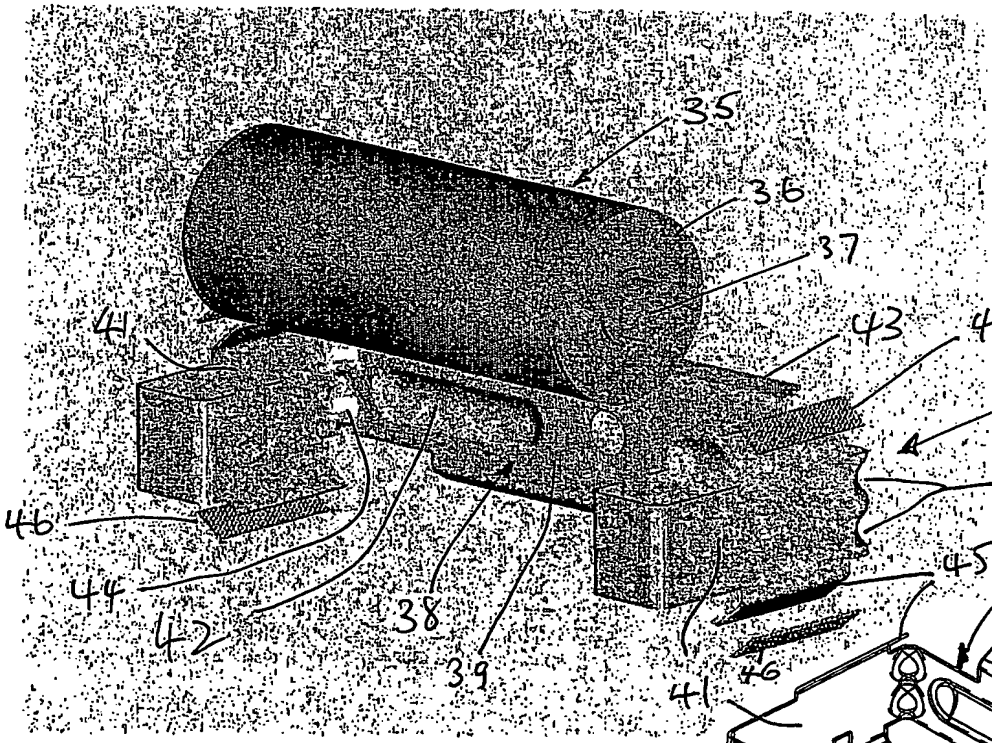

Figure 14

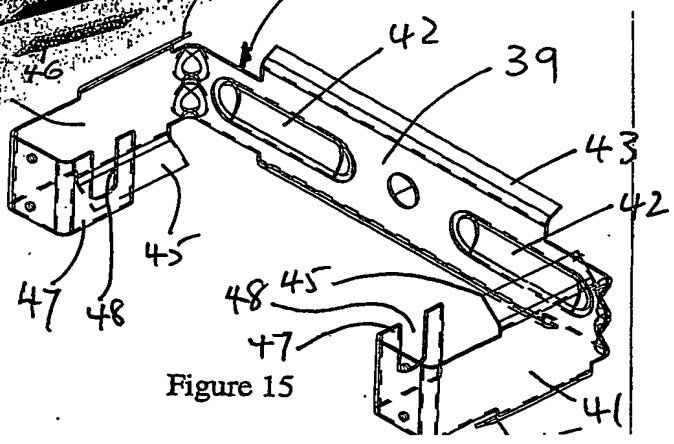

Figure 15

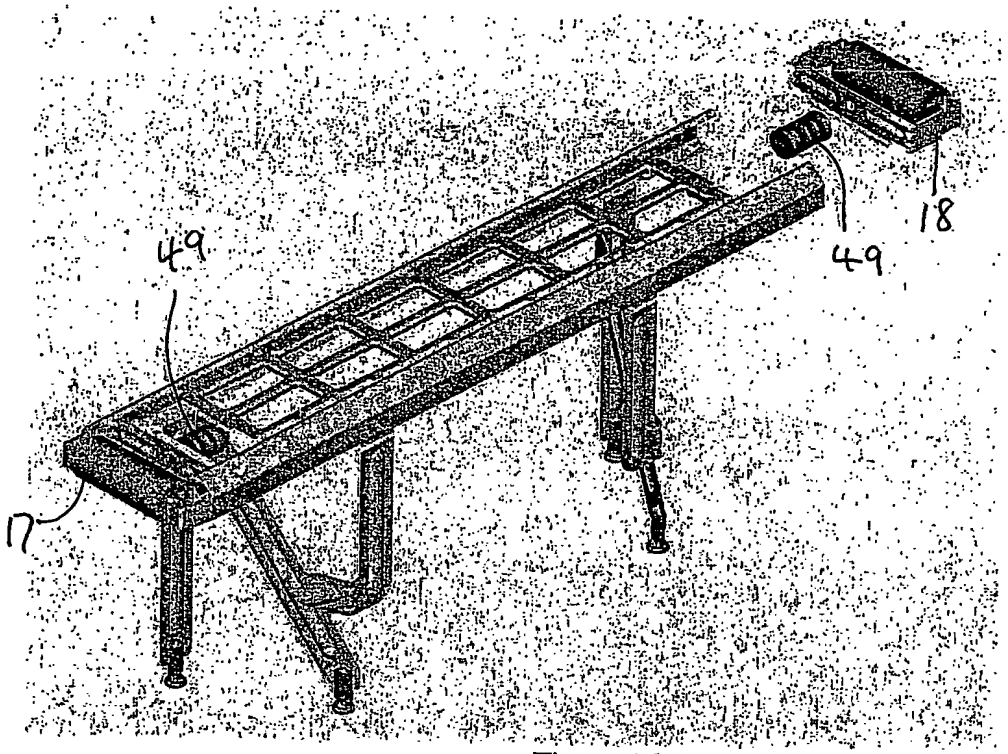

Figure 16

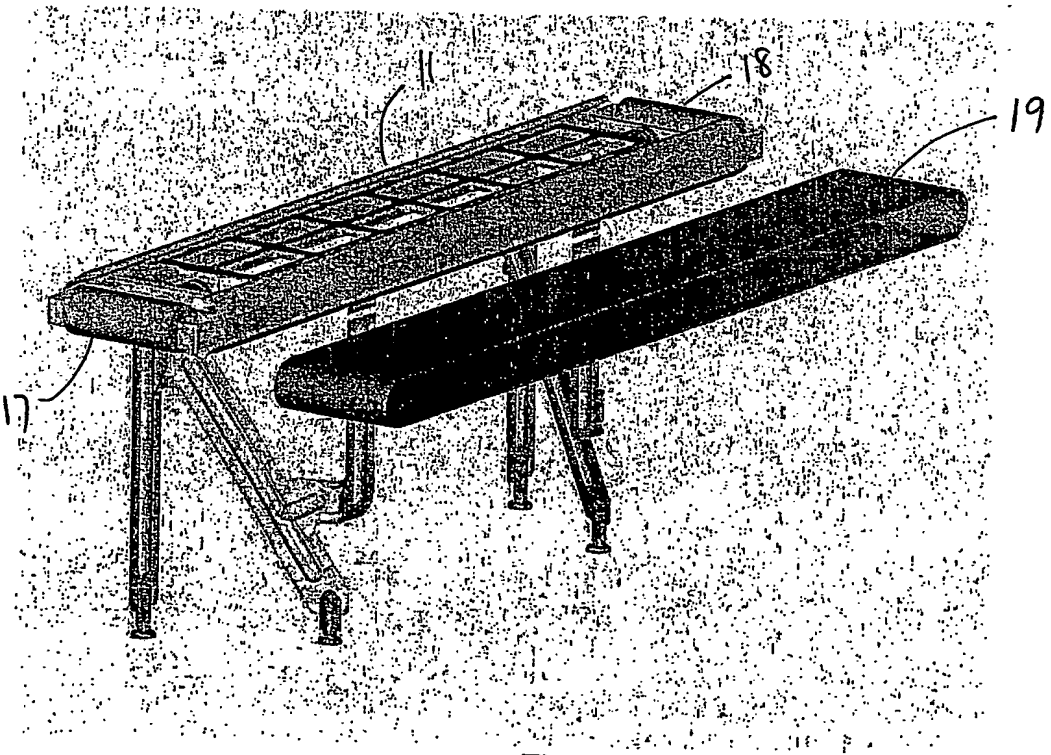

Figure 17

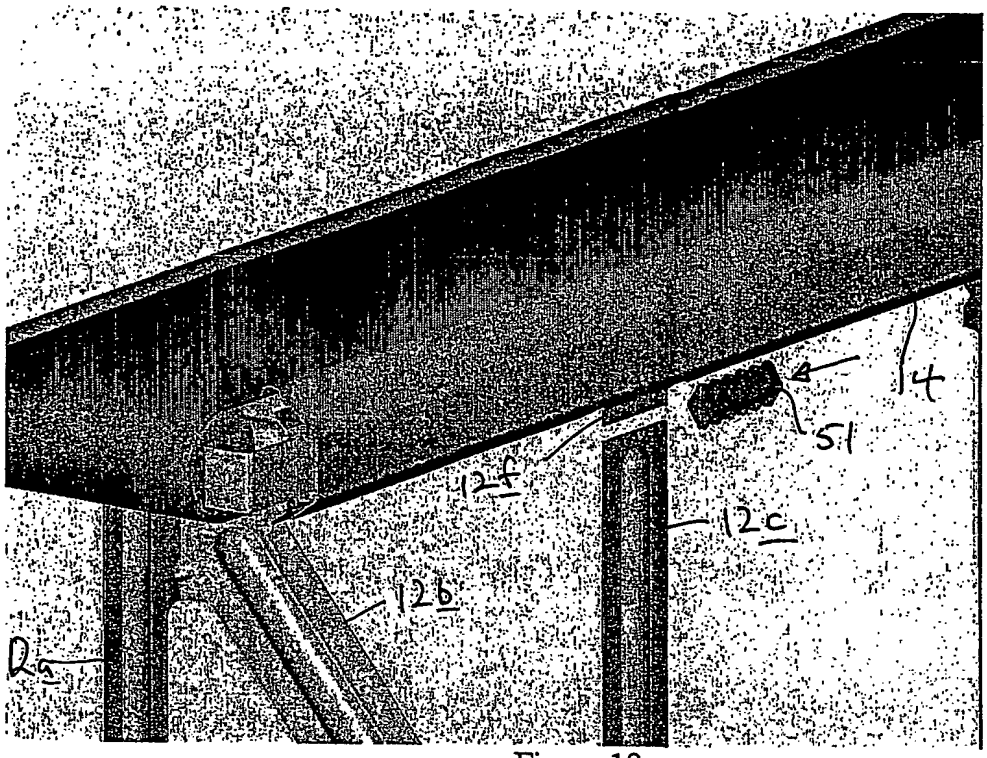

Figure 18

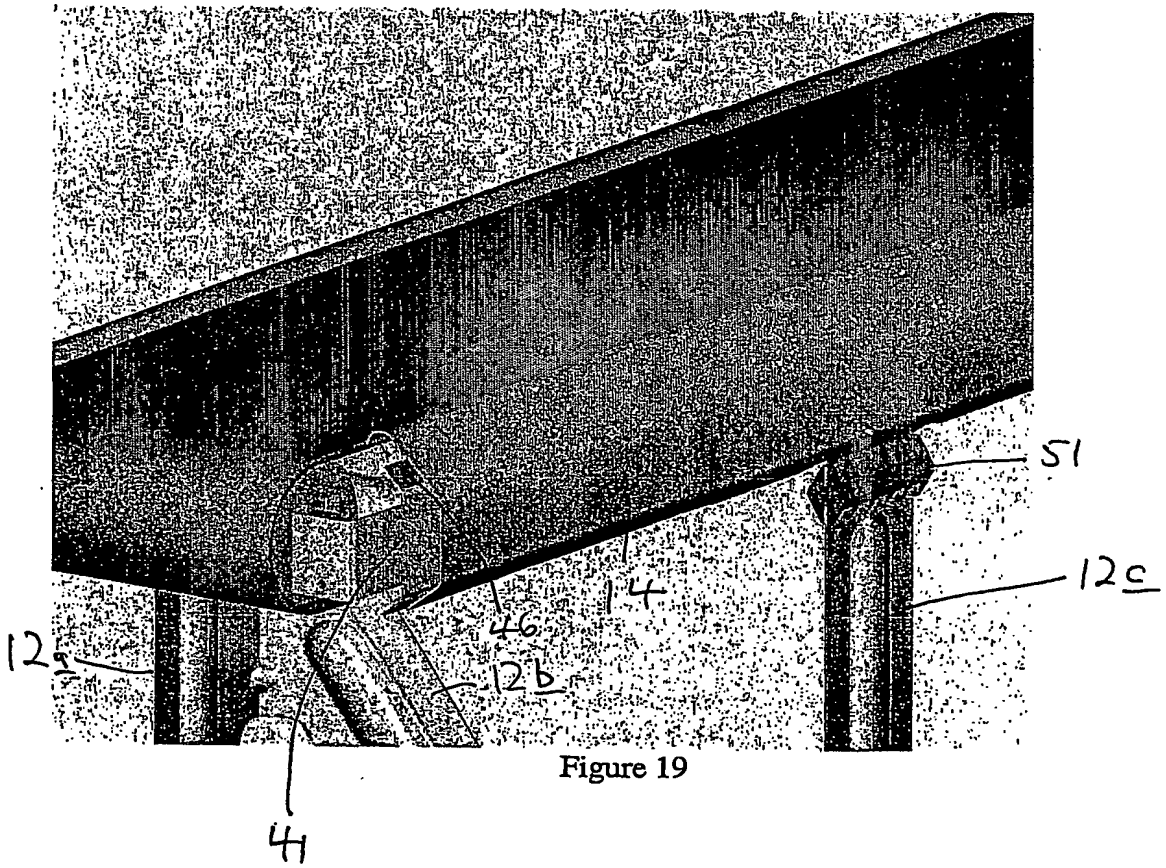

Figure 19

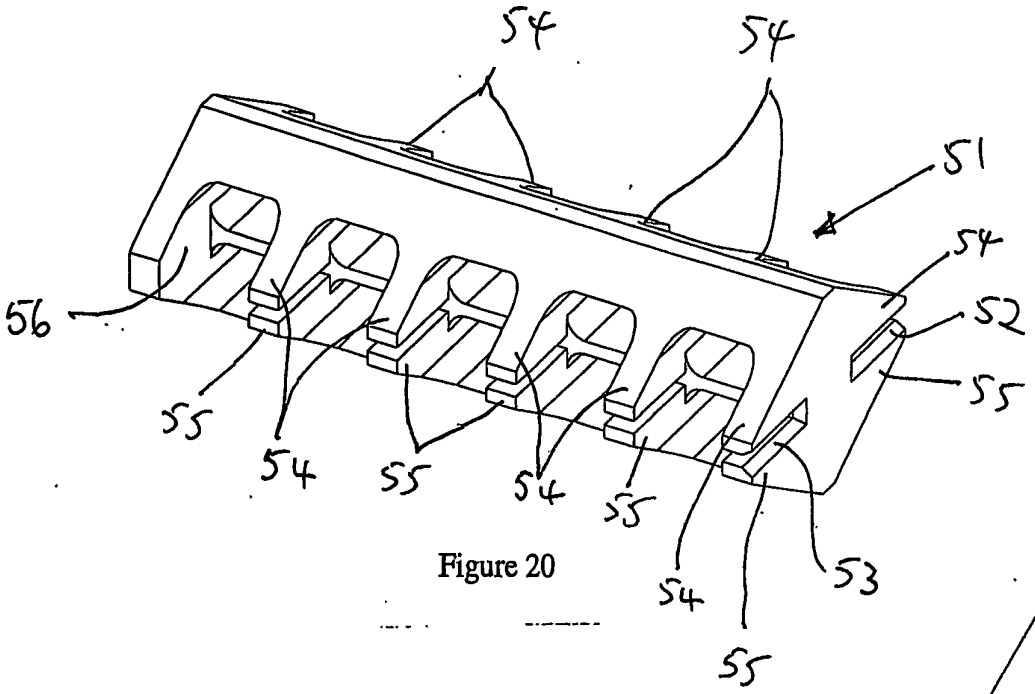

Figure 20

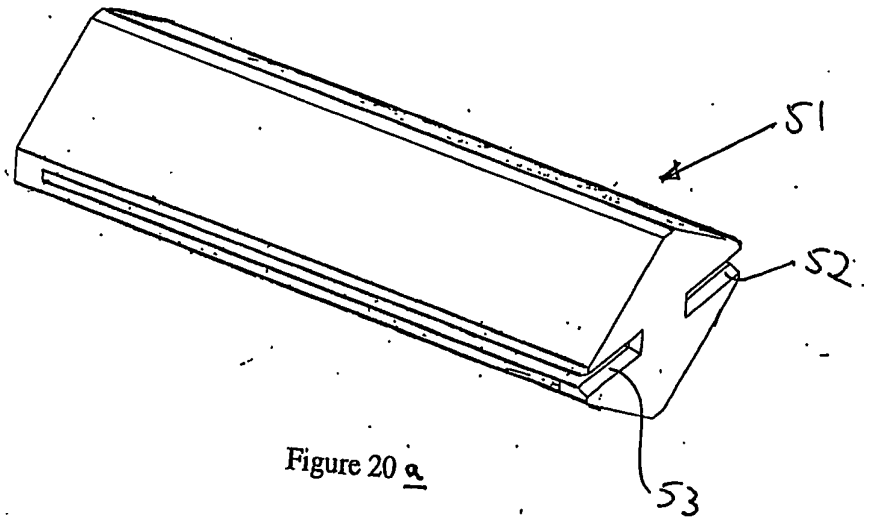

Figure 20a

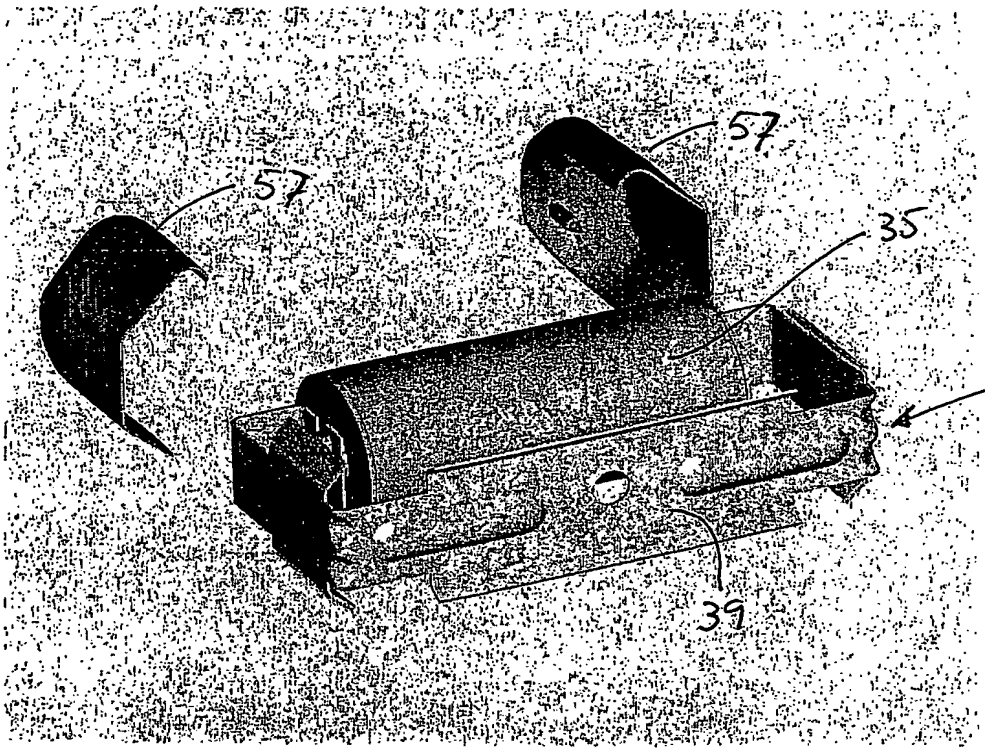

Figure 21

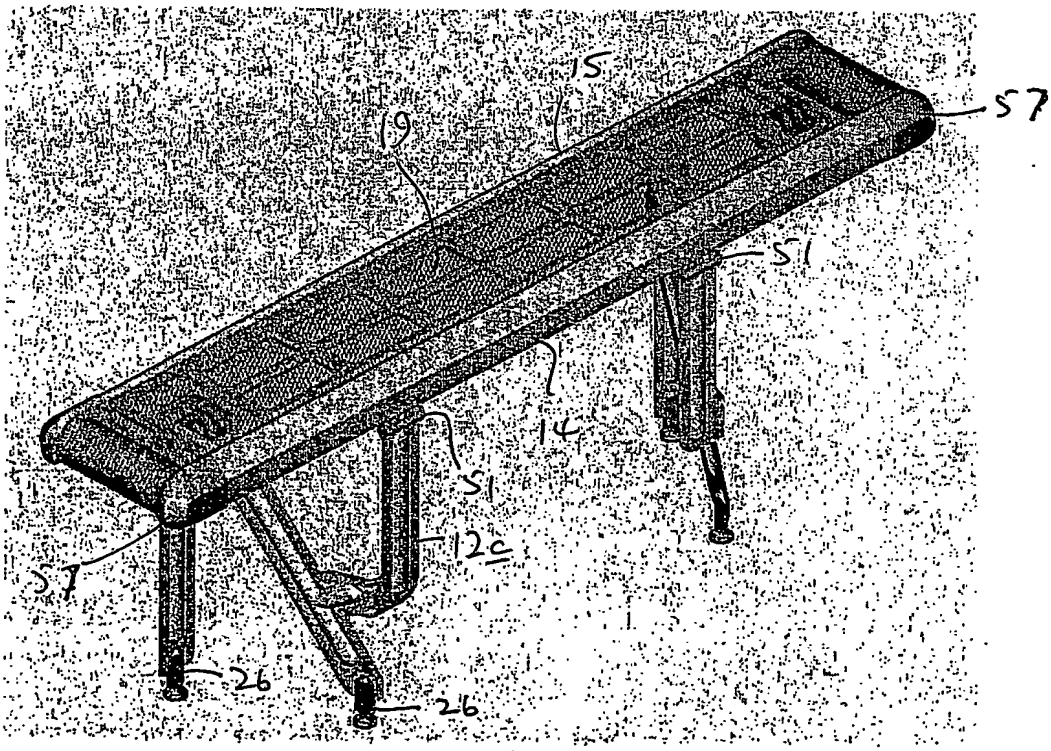

Figure 23

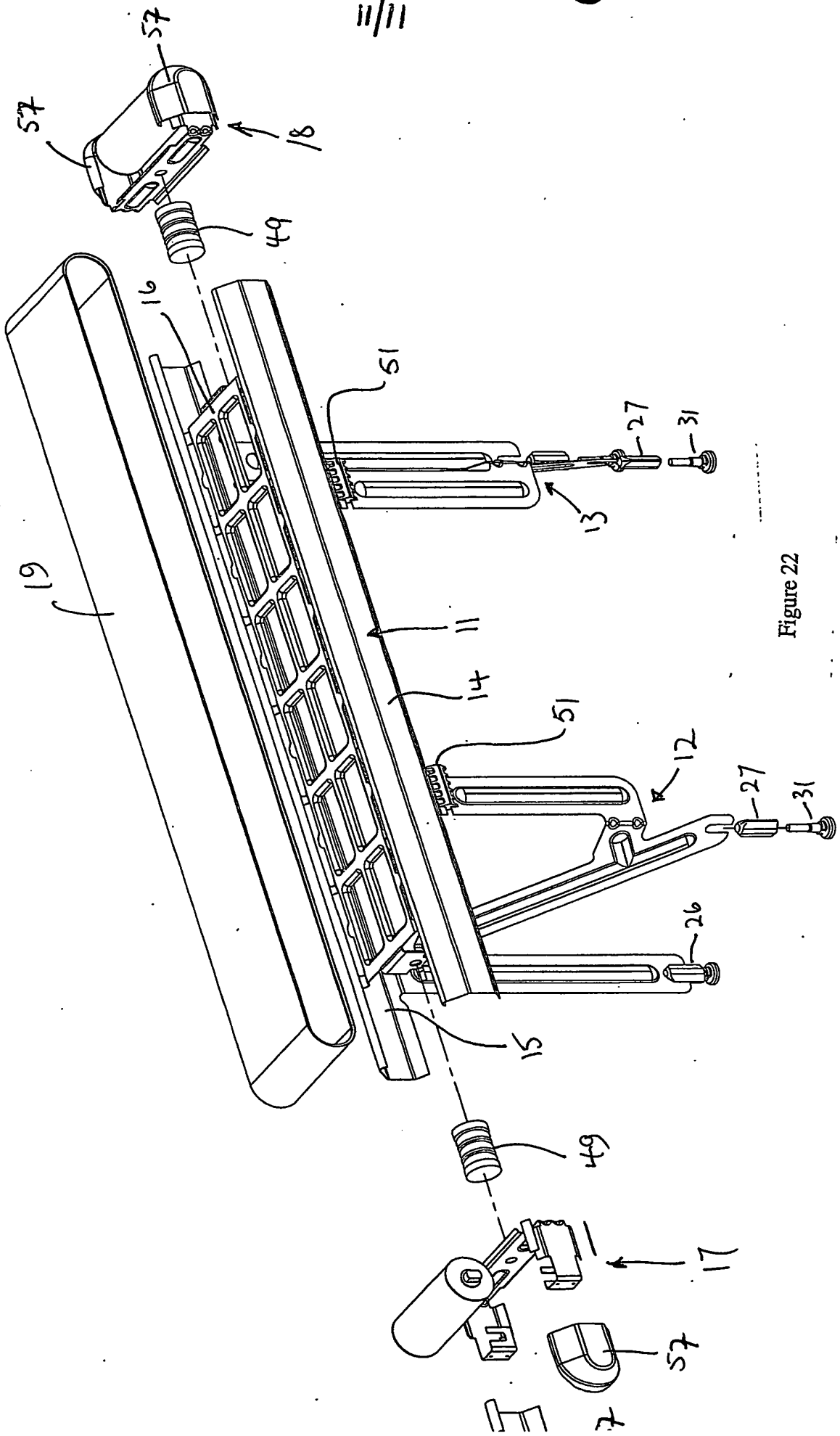

Figure 22